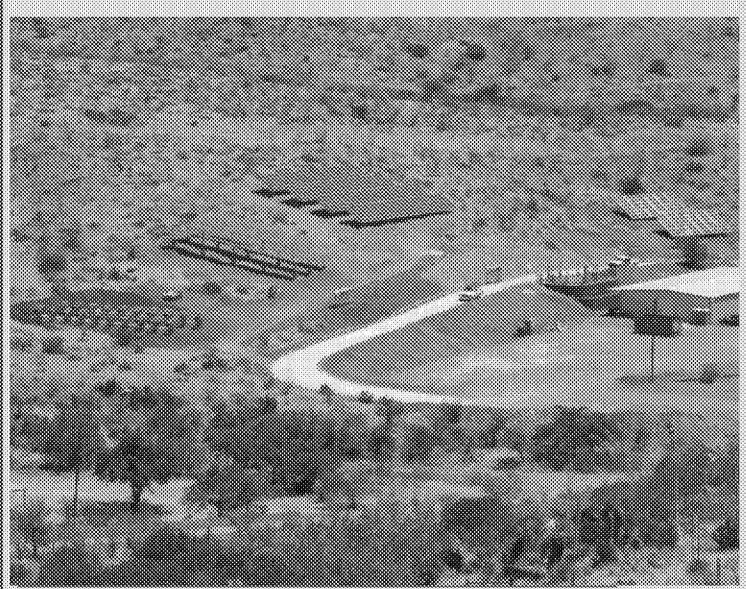
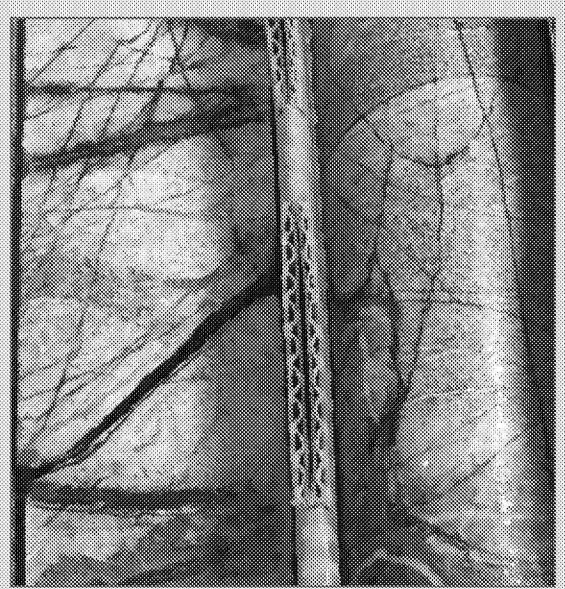
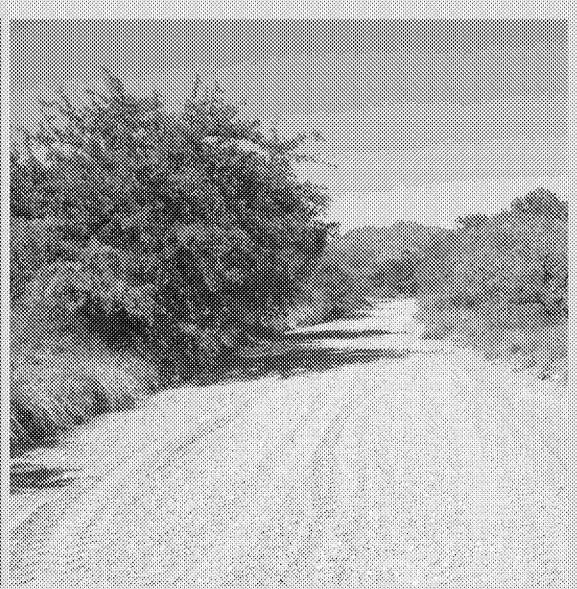
HUDBAY

Water Quality Discussion







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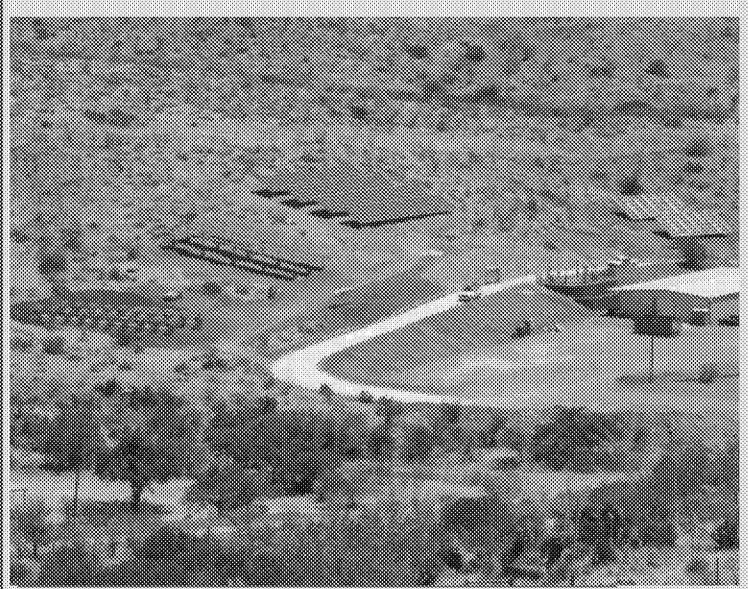
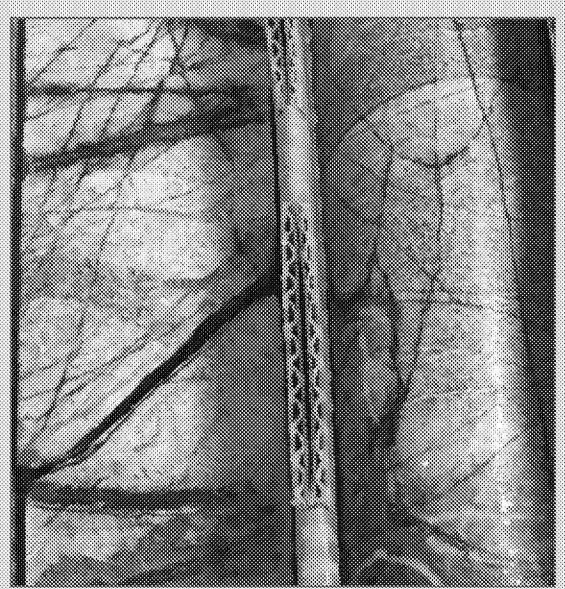
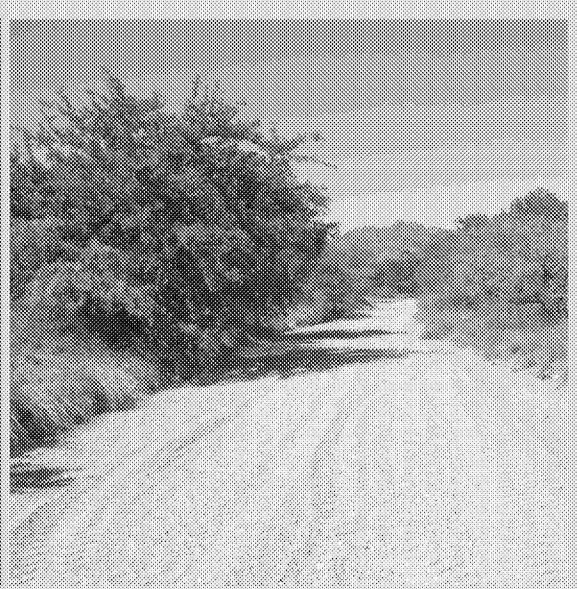
Discussion

- Rosemont Project
- Does fill activity cause a violation of SWQS
- Does fill activity *degrade* water quality at the OAW
- Summary
- Appendix

HUDBAY

ROSEMONT PROJECT

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Rosemont Project

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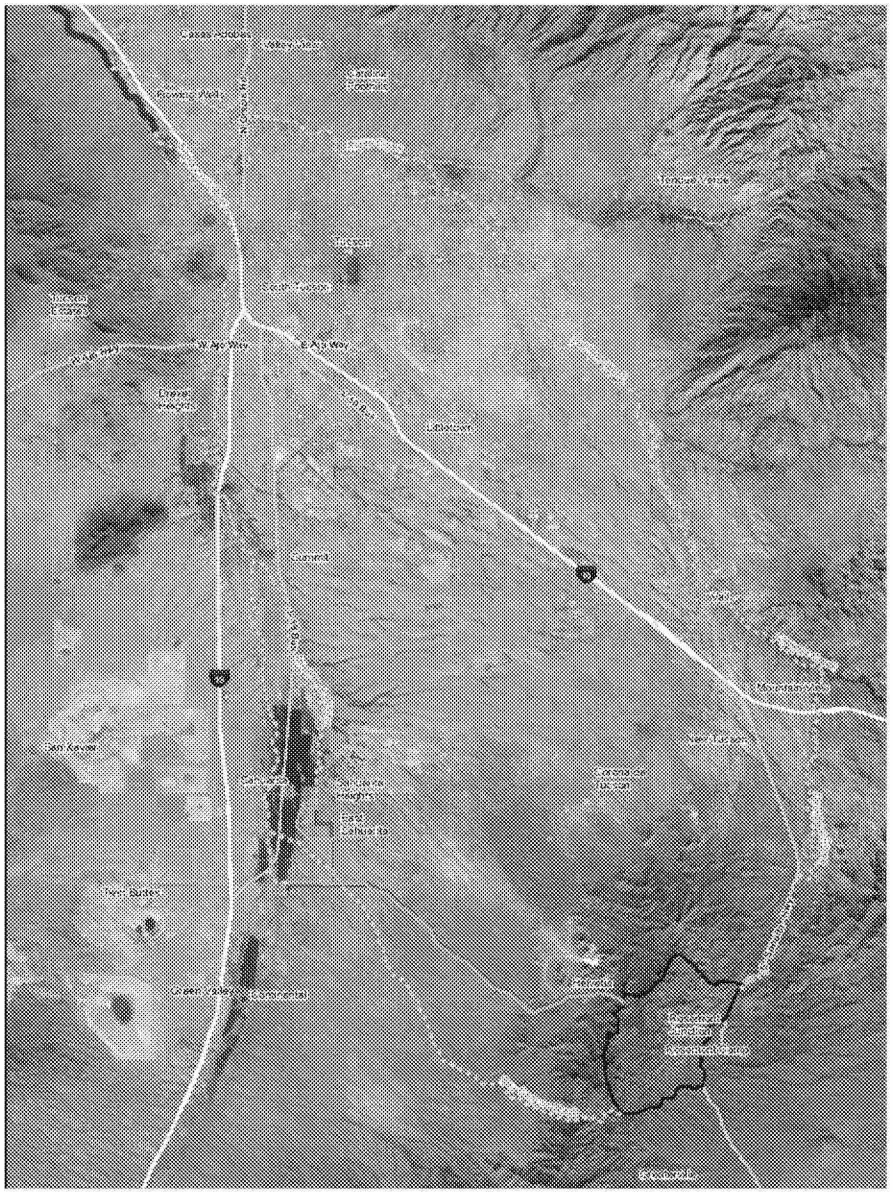
LOCATION

- Over 50 miles upstream from nearest downstream potential TNW - Santa Cruz River, Study Reach B (red)
- Drainage path flows north:
  - Barrel Canyon
  - Davidson Canyon
  - Lower Cienega Creek
  - Pantano Wash
  - Rillito Creek
  - Santa Cruz River
- Drainage path includes:
  - Stock ponds and diversion structures
  - Grade control structures
  - Diversion Dam (Pantano Dam)
  - Developed drainages to maintain stormwater system that include hardened channel
  - Numerous poles, wash crossings, bridges, etc.

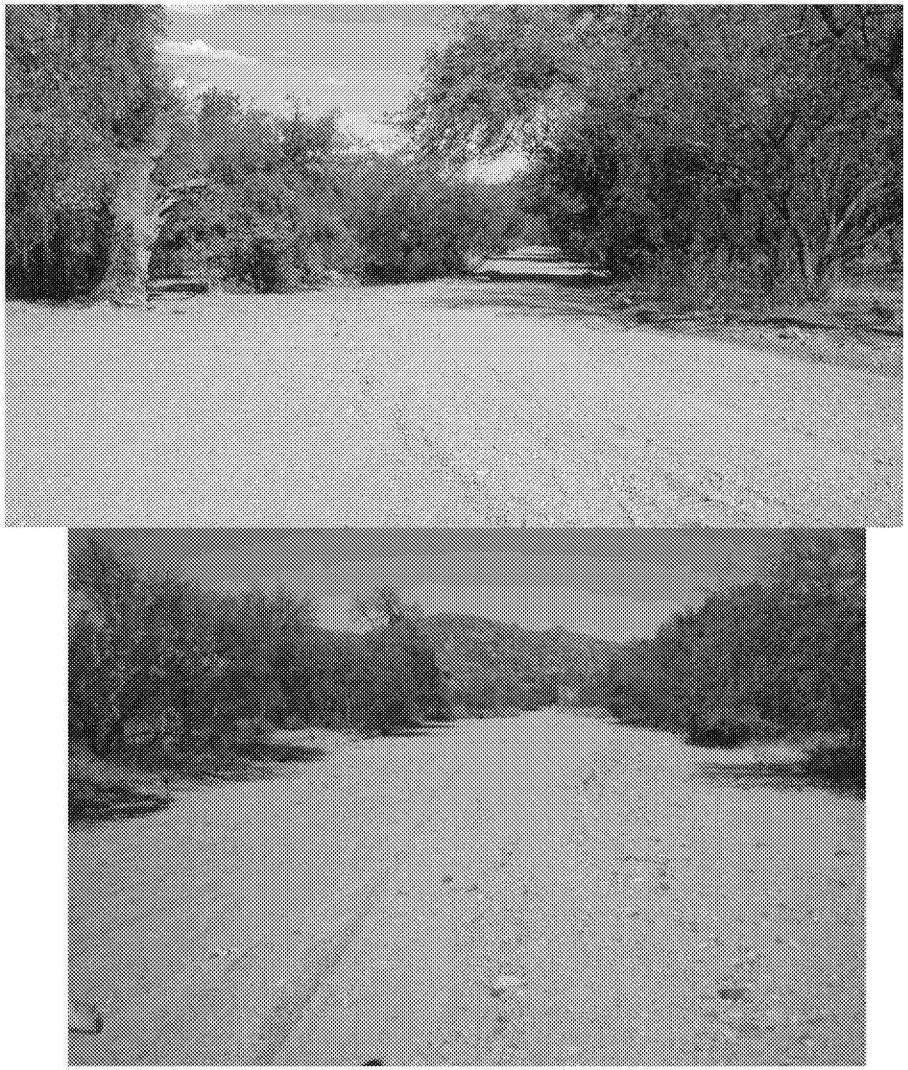


404 Permit: Resource Overview

HUDBAY

CLARIFICATION OF "AQUATIC" RESOURCES ON-SITE:

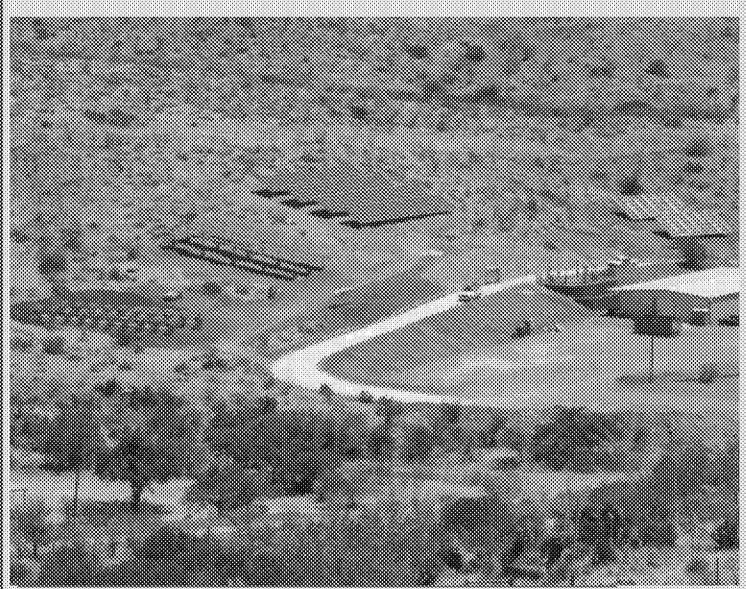
- Onsite drainage features are dry washes that only flow briefly after storm events
- No wetlands, special aquatic sites, or other specially designated waters on site
  - Do not support resident fish or other aquatic species
- Largest washes are used as numbered and maintained Forest Service roads
- OHV use would be primary recreation use – no aquatic use
- Stormwater quality exceeds SWQS for As, Cu, Pb, and Se

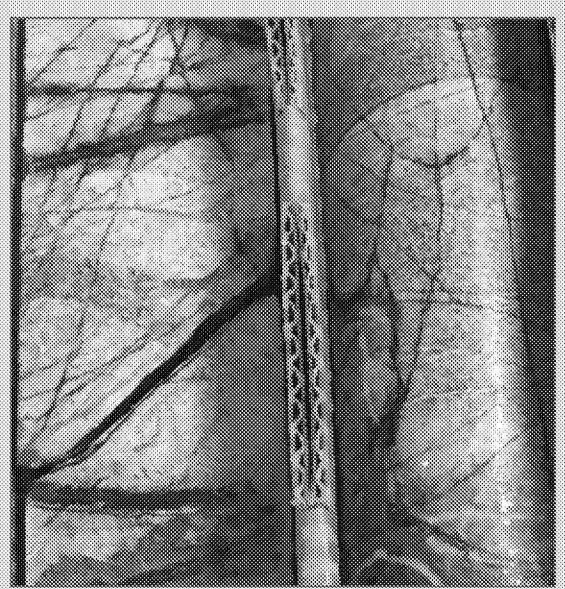


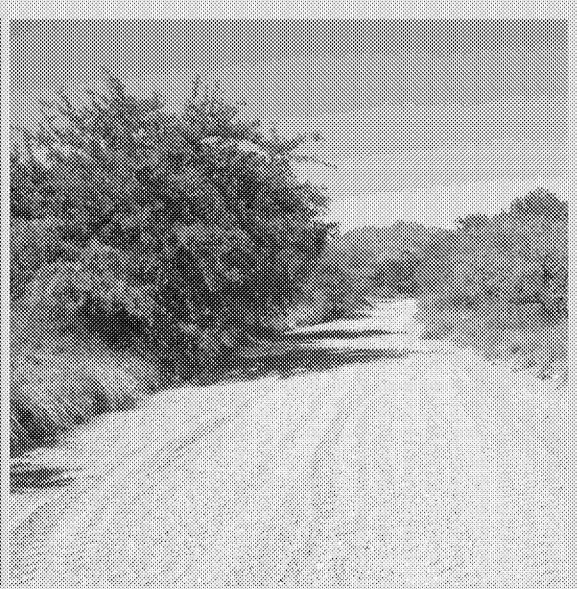
Photograph 4. Looking downstream toward wide and shallow channel geometry in Barrel Canyon

HUDBAY

Fill impact to SWQS







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Evaluating Current Condition

HUDBAY

BASELINE EVALUATIONS COMPLETED:

- Evaluation
  - Geochemical testwork of coarse reject and split core samples
  - Peak flows and average annual runoffs from site
  - On-site and off-site surface water quality and quantity
  - Baseline measure of fluvial geomorphology
- Monitoring
  - Stormwater as well as quarterly spring sampling and flow measurement
  - In-wash monitoring in two locations plus stormwater sampling over multiple locations
  - Meteorology station and scattered precipitation stations
  - USGS gage installed in 2009
- Method
  - Whole rock analysis
  - SPLP/MWMP
  - Humidity cell testing
  - USGS methods, regression analysis, HEC-HMS, PC-Hydro
  - Organic, inorganic, and metals analysis
  - LIDAR, size analysis, and riparian survey
  - Meteorological information including rainfall, evaporation, wind, temperature, and humidity

Conservative Water Quality Analysis

HUDBAY

EVALUATION OF WATER QUALITY IMPACT:

- **Conservative** calculations:
  - Used a low hardness value (88) when compared to on-site data (range of 80-2800)
  - Did not include segregation of geochemically active materials
  - Excluded values that did not have acceptable detection levels which skewed averaging of analysis higher on detected analytes
- Screening analysis showed compliance with SWQS
  - Forest Service and ADEQ determined water quality would not be degraded
- Stormwater runoff from the site has high levels of metals, specifically lead (total), copper (total and dissolved), arsenic (total), and selenium (total)
  - Waste rock geochemical testing (SPLP, MWMP, HCT) better than baseline stormwater runoff

Conservative Flow Calculations

HUDBAY

CALCULATION OF FLOW REDUCTION:

- **Actual** runoff measurements from USGS gage ranged between 41.5 to 189 acre-feet
- ***Conservative*** calculation did not incorporate:
  - Did not incorporate:
    - Stock tanks or other diversions of flow
    - Site specific transmission losses
    - Evapotranspiration losses
  - Assumed that rain fell throughout the area of calculation at the same rate
  - Used an average annual rainfall number based on long-term records from stations in the area
- Flow calculations are not ***predictions:***
  - Calculated permanent decrease in annual runoff of 242 AFY at the USGS gage near the site (average annual runoff was estimated to be 1,407 AFY)
  - Actual flows have been less than 10% of the calculated average annual runoff

Barrel Canyon Flows

HUDBAY

RUNOFF ASSOCIATED WITH THE USGS GAGE AT BARREL CANYON

Year	Number of Days of Flow	Annual Runoff Volume (in acre-feet)
Project runoff modeled at 1,400 ac-ft per year with a reduction of 242 ac-ft per year		
2010	9	44.62
2011	9	188.96
2012	14	133.88
2013	6	41.54
2014	13	51.98
2015	21	185.61
2016	16	168.07
Avg	12.5	116.38

SWQ Summary

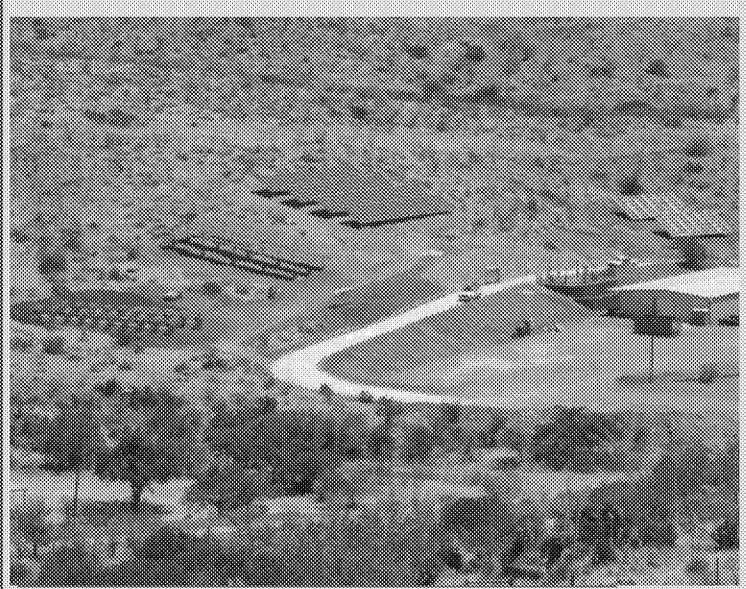
HUDBAY

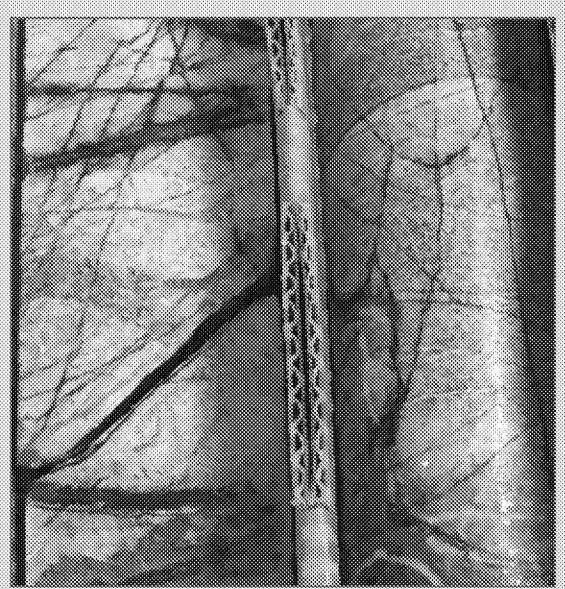
WATER QUALITY (FEIS PP.362-398 (GROUNDWATER), PP.443-485 (SURFACE WATER))

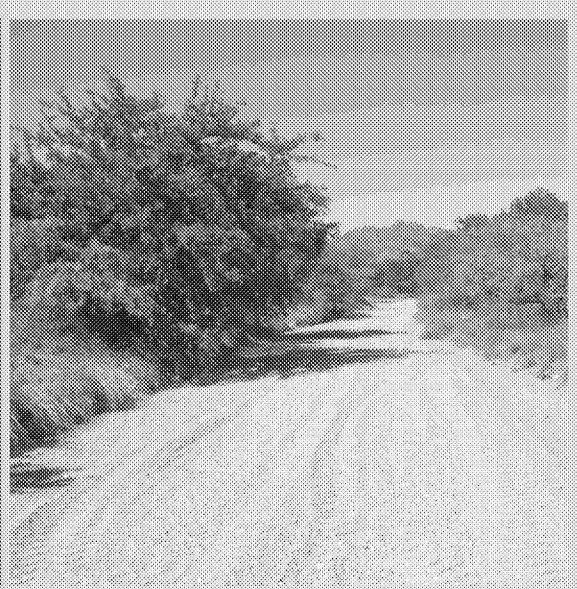
- The Arizona Department of Environmental Quality has assured protection of water quality through issuance of all necessary permits:
  - Aquifer Protection Permits (groundwater)
  - Stormwater Permits (surface water runoff)
  - 401 Certification (fill activity)
- Each of ADEQ's permits include:
  - Required technology and/or best management practices
  - Sampling, monitoring, and reporting obligations
  - Enforcement mechanisms
- Forest Service concluded:
  - Project will not cause exceedances of Arizona's Aquifer Water Quality Standards
  - "Predictions of runoff water quality from the tailings and waste rock facilities … is not expected to degrade the existing surface water quality … ."

HUDBAY

Fill impact to OAW (Tier III Water)







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Davidson Canyon Wash

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DRAINAGE I-10 TO REACH 2 SPRING AND REACH 2 SPRING

- Nearest Outstanding Arizona Water (OAW) is approximately 13 miles downstream from Rosemont Project site
  - Over 70% of the OAW is designated by the state as ephemeral which does not meet criteria for listing as OAW
  - Intervening road crossings, wells, septic systems, water supply wells, stock tanks and associated ranching facilities, a winery, a quarry, etc.
  - **Does not currently meet water quality standards during storm events**

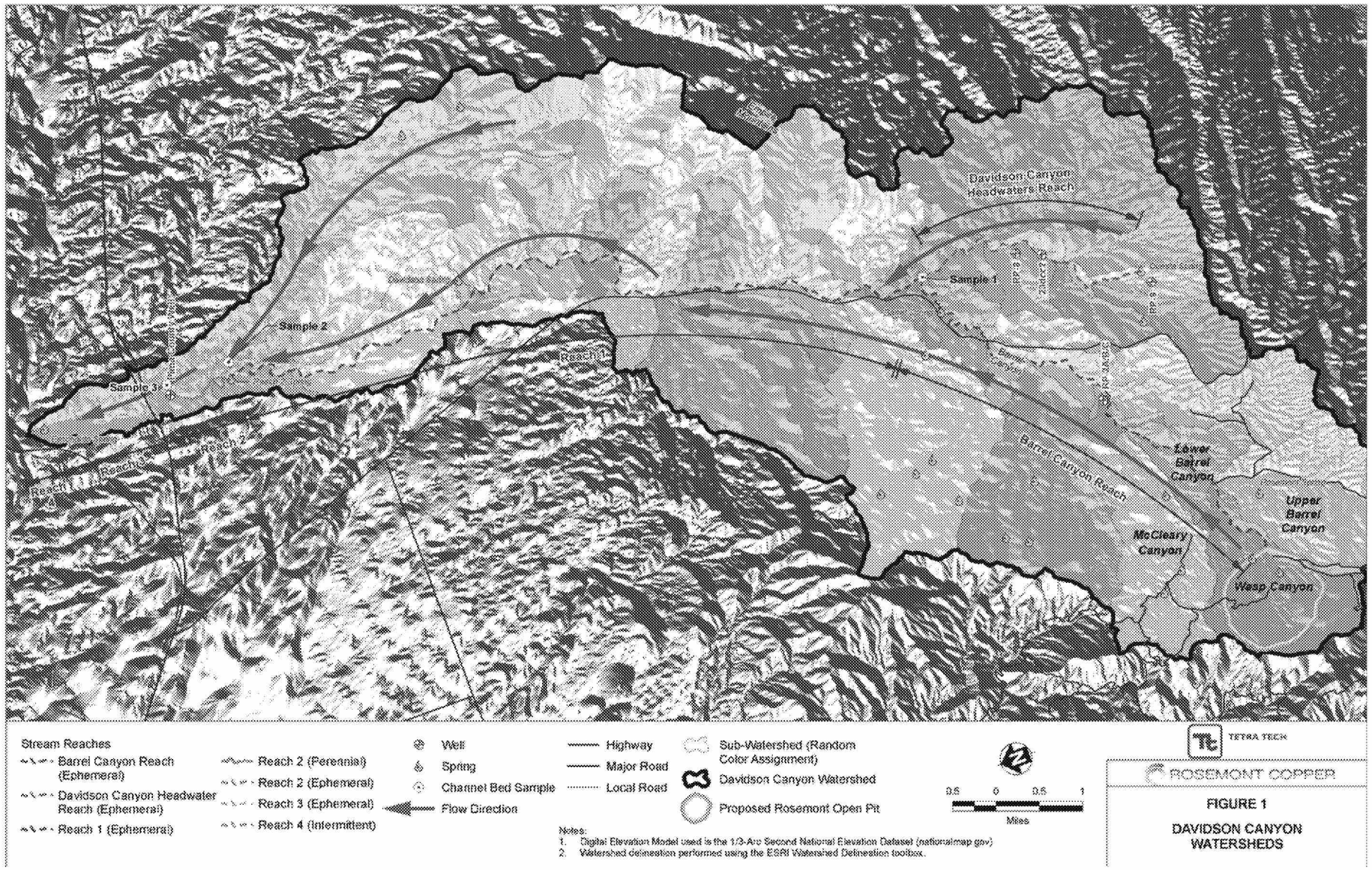
Evaluating Current Condition

HUDBAY

BASELINE EVALUATIONS COMPLETED:

- Evaluation
  - Peak flows from the site
  - Average annual runoffs
  - Off-site surface water quality and quantity
  - Baseline measure of fluvial geomorphology
  - Davidson Canyon watershed, drainage, and water sources for springs
- Monitoring
  - In-wash monitoring upstream of the OAW but outside Barrel Canyon
  - Quarterly spring sampling and flow measurement
  - Stock tank measurements of content and capacity
- Method
  - USGS methods, regression analysis, HEC-HMS, USGS flow measurements
  - LIDAR, screen sizing, and riparian survey
  - Tritium, carbon dating, and isotope analysis
  - Organic, inorganic, and metals analysis

Davidson Canyon Watersheds



Davidson Canyon

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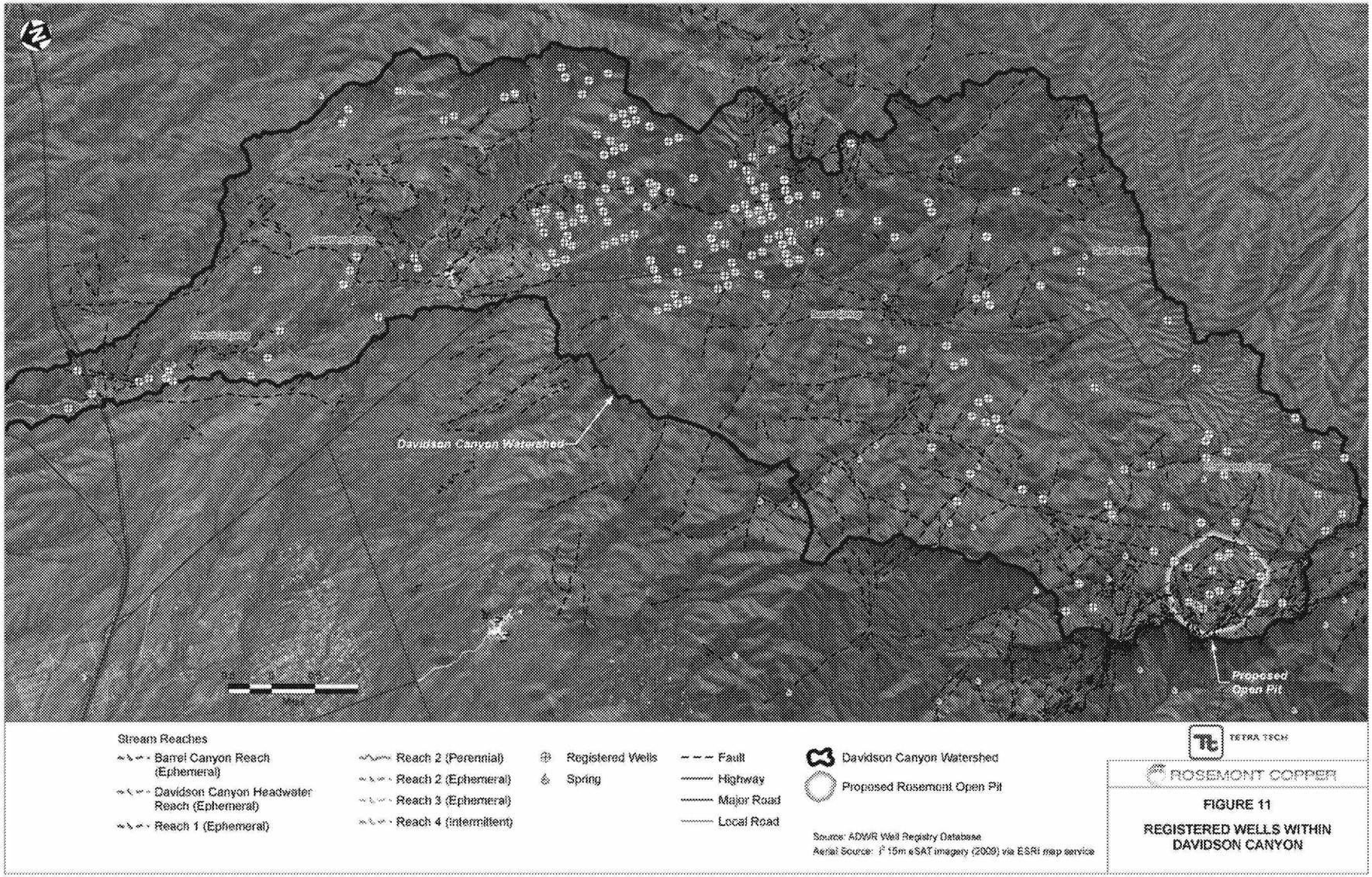

Davidson Canyon OAW

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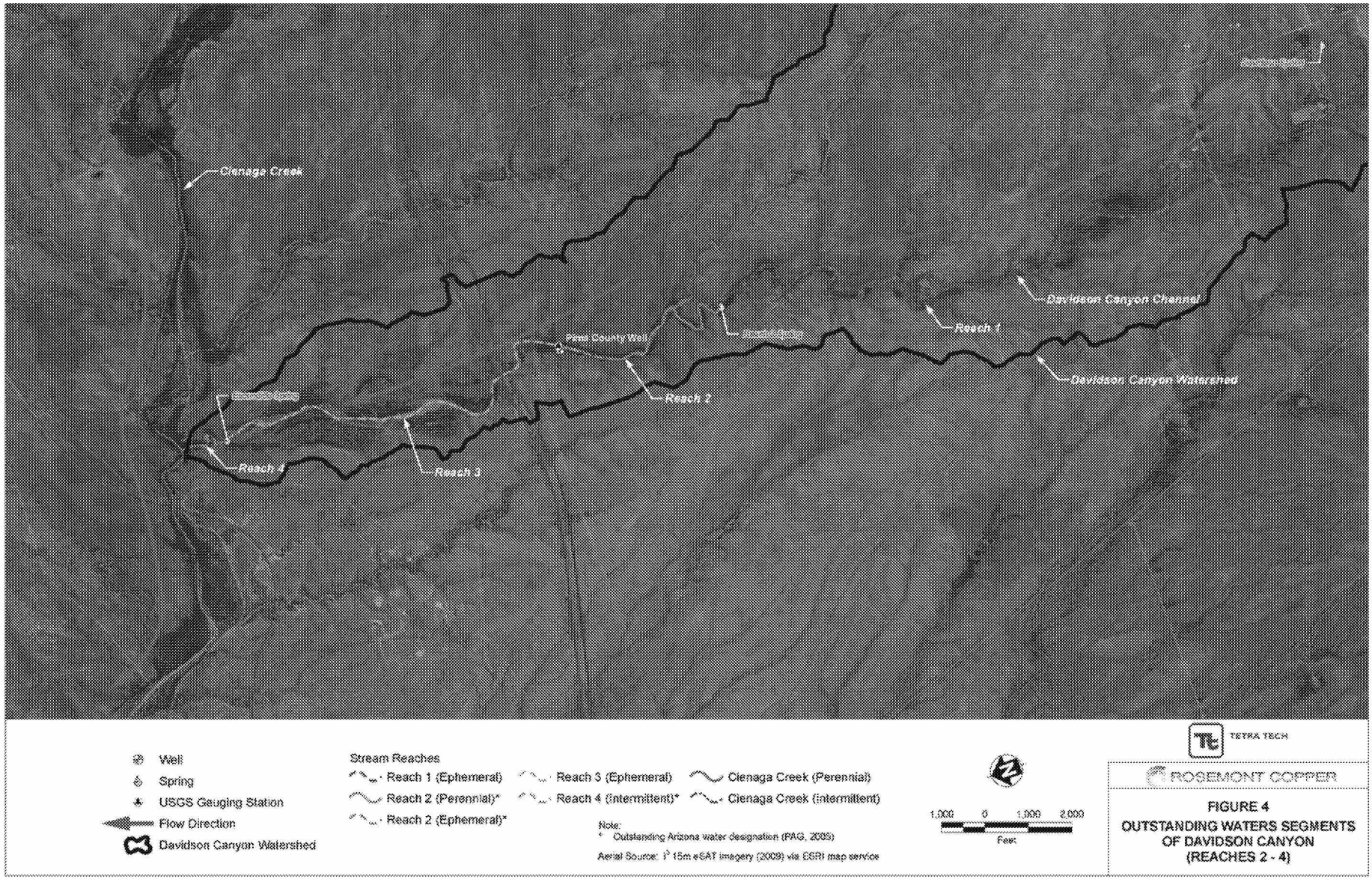


Conservative Flow Calculations

HUDBAY

CALCULATION OF FLOW REDUCTION:

- **Calculation** of modeled permanent decrease in annual runoff of 4.3% at the OAW reach of Davidson Canyon based solely on area and average rainfall
- **Conservatively**, the model:
  - Did not incorporate
    - Stock tanks or diversions of flow between the site and the OAW
    - Site specific transmission losses
    - Evapotranspiration losses
  - Assumed that rain fell throughout the area modeled at the same rate
  - Used an average annual rainfall and was based on long-term records
- Data from monitoring in Davidson Canyon (4 miles downstream) shows:
  - **Conservative** runoff values– Monitoring station at Davidson Canyon registered flow 10 times compared to flow 60 times at a monitoring station in Barrel Canyon
  - **Models** are conservative for both rainfall and runoff – only 15% of the time traveled only 4 miles let alone a distance of 13 miles.

Conservative Water Quality Analysis

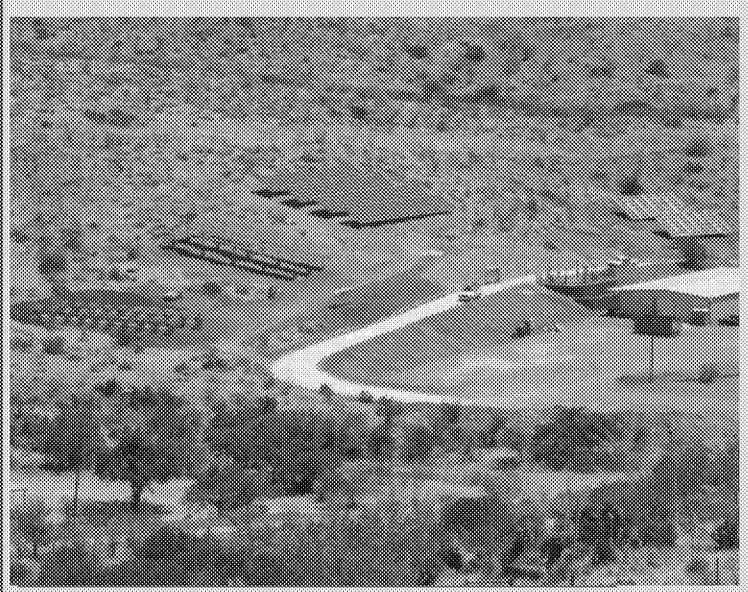
HUDBAY

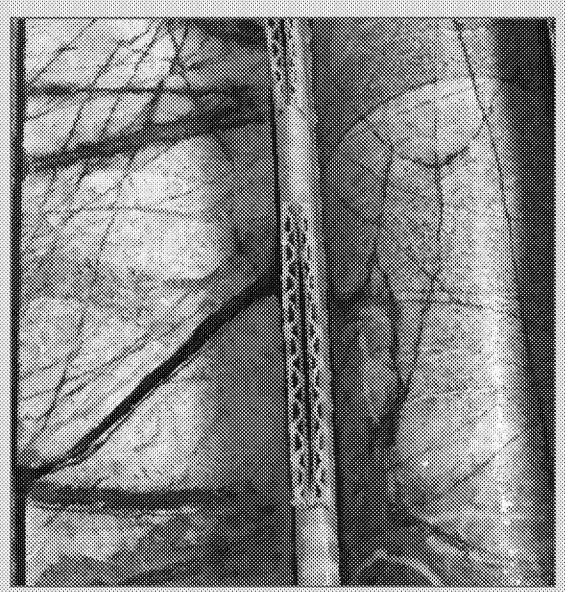
EVALUATION OF WATER QUALITY DEGRADATION:

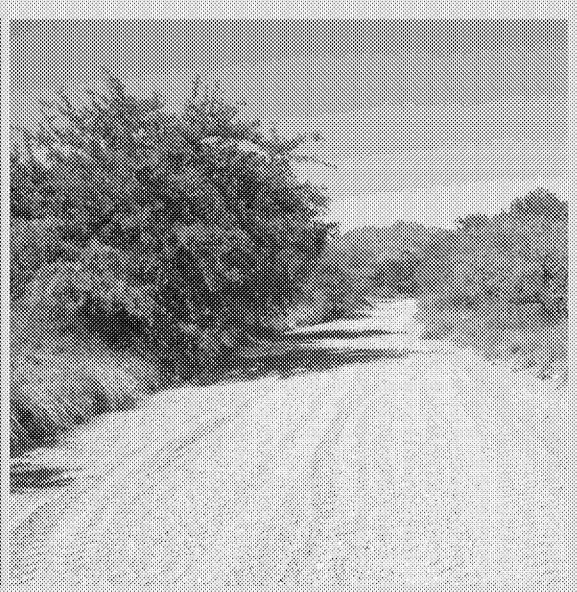
- **Conservative** calculations, did not account for:
  - Dilution over the 13 stream-miles to the OAW
  - Existing stormwater quality at the OAW – no baseline sampling of stormwater was performed at the OAW for the listing or for the EIS analysis
  - Existing stormwater quality in Davidson with consistent lead (total) and copper (total and dissolved) exceedances of standards
- **Extremely low risk** of lowering of water quality:
  - Stormwater regulated under MSGP
  - Stormwater quality on-site, in Davidson Canyon, at the Davidson Canyon OAW and at Cienega Creek (OAW) above and below the Davidson Canyon confluence currently exceeds standards
  - Only opportunity for degradation would be stormwater discharge from waste rock specifically managed to isolate geochemically active material

HUDBAY

SUMMARY







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Summary

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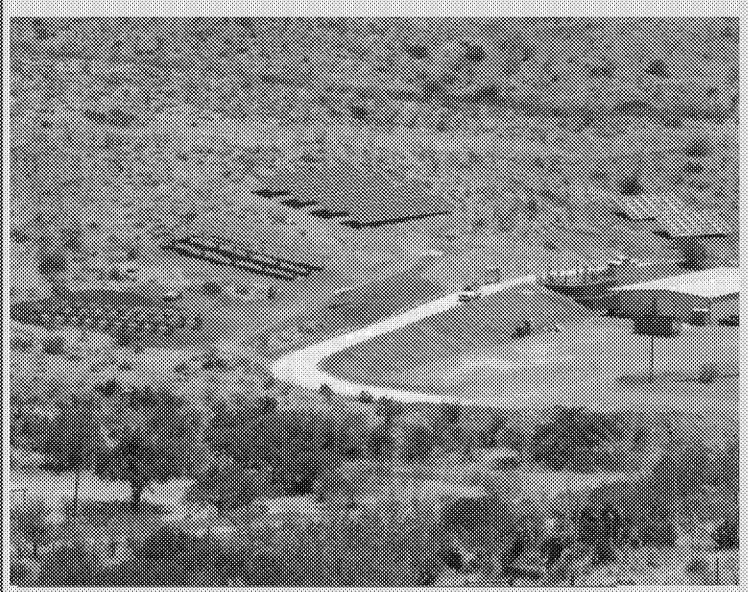
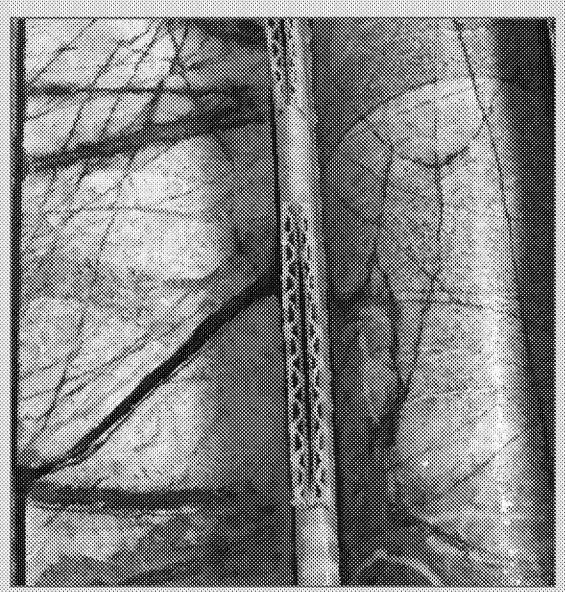
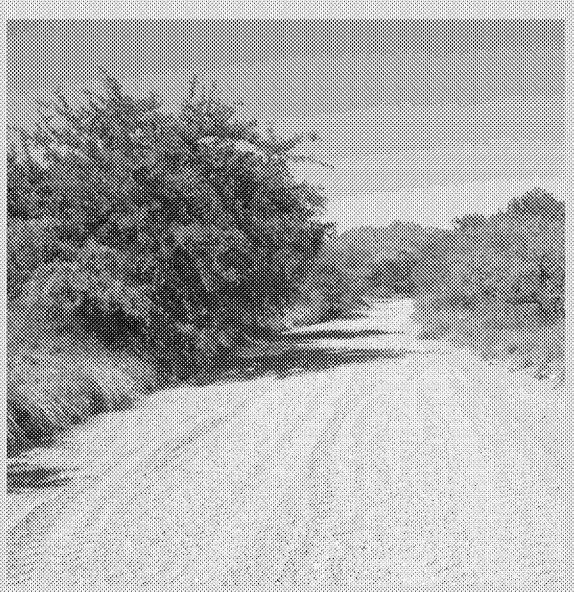
- ***Conservative calculations*** performed to for impacts on runoff
  - Decrease of annual runoff - 242 AFY higher than baseline measurements
  - Calculated peak discharge for Barrel Canyon (14 square miles) at 8,072 cfs exceeds highest measured peak discharge for Pantano Wash (450 square miles) at 2,230 cfs by 3.6
- ***Surface water quality*** impacts estimated to be less than current baseline
  - Baseline stormwater quality does not meet surface water quality standards on-site or at OAW
  - Testing showed no potential to impact stormwater with appropriate management of materials
  - Analysis used low hardness values (88 vs. 250-400) when calculating standards
- Baseline data gathered to support analysis including:
  - Water quality
  - Geomorphology
  - Riparian areas
  - Flows

HUDBAY

Questions?

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